

WHAT IS CLAIMED IS:

- 1 1. A thermal transfer system, comprising:
2 a container for receiving a medium;
3 a structure positioned in the container such that the structure segments the
4 container into a plurality of compartments wherein a distal end of the structure is in
5 close proximity to an interior surface of the container to allow formation of a thermal
6 transfer bridge that conducts heat into or out of the medium.
- 1 2. A thermal transfer system as in claim 1 including:
2 a heating or cooling device coupled to and provides heating or cooling of the
3 container.
- 1 3. A thermal transfer system as in claim 1 including:
2 a heating or cooling device coupled to and provides heating or cooling of the
3 structure.
- 1 4. A thermal transfer system as in claim 1 including:
2 a heating or cooling device coupled to and provides heating or cooling of the
3 container and the structure.
- 1 5. A thermal transfer system as in claim 1 including:
2 a plurality of structures in the container.
- 1 6. A thermal transfer system as in claim 1, including:
2 a removable liner configured to cover at least a portion of the structure.
- 1 7. A thermal transfer system as in claim 1 wherein:
2 a volume of the container is in the range from substantially 1 liter to 250
3 liters.
- 1 8. A thermal transfer system as in claim 1 wherein:
2 a volume of the container is in the range from substantially 250 liter to
3 10,000 liters.
- 1 9. A thermal transfer system as in claim 1 wherein:

2 the distal end of the structure contacts at least a portion of the interior surface
3 of the container.

1 10. A thermal transfer system as in claim 1 wherein:
2 a distance between the distal end of the structure and the interior surface of
3 the container is a non-contacting distance not greater than one inch.

1 11. A thermal transfer system as in claim 1 wherein:
2 the container includes a jacket defining an interstitial space positioned
3 between the jacket and a wall of the container for receiving a flow of a heat exchange
4 fluid, the jacket further including a plurality of spiral baffles for enhancing thermal
5 exchange between the heat exchange fluid and the container.

1 12. A thermal transfer system as in claim 1 wherein:
2 a heat exchange fluid flows within the structure.

1 13. A thermal transfer system as in claim 12 wherein:
2 an interior portion of the structure has baffles.

1 14. A thermal transfer system as in claim 13 wherein:
2 the structure is configured to maximize an area of a surface of the structure
3 that is in contact with the medium.

1 15. A thermal transfer system as in claim 12 wherein:
2 a heat exchange extension is at least partially coupled to the structure.

1 16. A thermal transfer system as in claim 1 wherein:
2 the medium is substantially uniformly heated or cooled.

1 17. A thermal transfer system as in claim 1 wherein:
2 the medium is heated or cooled in substantially one direction relative to the
3 structure.

1 18. A thermal transfer system as in claim 1 wherein:
2 the structure is positioned to induce a thermal gradient in the medium such
3 that the thermal gradient is in a predetermined direction.

- 1 19. A thermal transfer system as in claim 1 wherein:
2 the medium is heated or cooled in a predetermined direction.
- 1 20. A thermal transfer system as in claim 1 wherein:
2 the medium is heated or cooled such that the thermal gradient is in a
3 predetermined direction.
- 1 21. A thermal transfer system as in claim 1 wherein:
2 the medium is heated or cooled at a predetermined rate.
- 1 22. A thermal transfer system as in claim 1 wherein:
2 the medium is heated or cooled such that the thermal gradient is in a
3 predetermined direction and the heating or cooling occurs at a predetermined rate.
- 1 23. A thermal transfer system as in claim 1 wherein:
2 the medium is a biopharmaceutical product.
- 1 24. A thermal transfer system as in claim 1 wherein:
2 the container has a nonporous bottom.
- 1 25. A thermal transfer system as in claim 1 wherein:
2 the container has nonporous walls.
- 1 26. A thermal transfer system as in claim 1 wherein:
2 the container has a top.
- 1 27. A thermal transfer system as in claim 1 wherein:
2 the container has a nonporous top.
- 1 28. A thermal transfer system as in claim 1 including:
2 a distal portion of the structure configured to improve thermal transport of
3 the thermal transfer bridge.
- 1 29. A thermal transfer system as in claim 1 wherein:
2 the medium includes proteins.

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- 1 30. A thermal transfer system comprising:
2 a container for receiving a medium;
3 a structure positioned in the container, a heat exchange member at least
4 partially coupled to the structure and extending into the container wherein a distal
5 end of the heat exchange member is placed in close proximity to an interior surface
6 of the container to allow the formation of a thermal transfer bridge that conducts heat
7 into and out of the medium.
- 1 31. A thermal transfer system as in claim 30 wherein:
2 a heating or cooling device is coupled to and provides heating or cooling of
3 the container.
- 1 32. A thermal transfer system as in claim 30 wherein:
2 a heating or cooling device is coupled to and provides heating or cooling of
3 the structure positioned inside the container.
- 1 33. A thermal transfer system as in claim 30 wherein:
2 a heating or cooling device is coupled to and provides heating or cooling of
3 the structure and the container.
- 1 34. A thermal transfer system as in claim 30 wherein:
2 there is a plurality of heat exchange members.
- 1 35. A thermal transfer system as in claim 30, further comprising:
2 a removable liner configured to cover at least a portion of the heat exchange
3 member.
- 1 36. A thermal transfer system as in claim 30 wherein:
2 a volume of the container is in the range from substantially 1 liter to 250
3 liters.
- 1 37. A thermal transfer system as in claim 30 wherein:
2 a volume of the container is in the range from substantially 250 liter to
3 10,000 liters.

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- 1 38. A thermal transfer system as in claim 30 wherein:
2 the container includes a jacket defining an interstitial space positioned
3 between the jacket and a wall of the container for receiving a flow of a heat exchange
4 fluid, the jacket further including a plurality of spiral baffles for enhancing thermal
5 exchange between the heat exchange fluid and the container.
- 1 39. A thermal transfer system as in claim 30 wherein:
1 a heat exchange fluid flows within the structure.
- 1 40. A thermal transfer system as in claim 30 wherein:
2 the heat exchange fluid flows into the structure through an interior passage in
3 the structure.
- 1 41. A thermal transfer system as in claim 30 wherein:
2 the heat exchange fluid flows out of the structure through an outer passage in
3 the structure wherein one portion of the outer passage comprises an outer wall of the
4 structure.
- 1 42. A thermal transfer system as in claim 30 wherein:
2 a heat exchange fluid flows within the heat exchange member.
- 1 43. A thermal transfer system as in claim 39 wherein:
2 an interior portion of the structure has baffles.
- 1 44. A thermal transfer system as in claim 42 wherein:
2 an interior portion of the heat exchange member has baffles.
- 1 45. A thermal transfer system as in claim 39 wherein:
2 an interior portion of the portion of the structure extending into the container
3 has baffles.
- 1 46. A thermal transfer system as in claim 39 wherein:
2 the heat exchange fluid flows into the heat exchange member from the
3 structure.

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- 1 47. A thermal transfer system as in claim 30 wherein:
2 a heat exchange fluid flows into the heat exchange member from a heat
3 exchange supply line.
- 1 48. A thermal transfer system as in claim 38 wherein:
2 the heat exchange fluid flows does not flow through the distal end of the heat
3 exchange member.
- 1 49. A thermal transfer system as in claim 30 wherein:
2 a distance between the distal end of the heat exchange member and the
3 interior surface of the container is a non-contacting distance not greater than one
4 inch.
- 1 50. A thermal transfer system as in claim 30 wherein:
2 the medium is substantially uniformly heated or cooled.
- 1 51. A thermal transfer system as in claim 30 wherein:
2 the medium is heated or cooled in substantially one direction relative to the
3 structure.
- 1 52. A thermal transfer system as in claim 30 wherein:
2 the medium is heated or cooled at a predetermined rate.
- 1 53. A thermal transfer system as in claim 30 wherein:
2 the medium is heated or cooled such that the thermal gradient is in a
3 predetermined direction and the heating or cooling occurs at a predetermined rate.
- 1 54. A thermal transfer system as in claim 30 wherein:
2 the medium is a biopharmaceutical product.
- 1 55. A thermal transfer system as in claim 30 wherein:
2 the medium includes proteins.